

Timothy D. Scheibe Pacific Northwest National Laboratory, Richland, Washington, USA

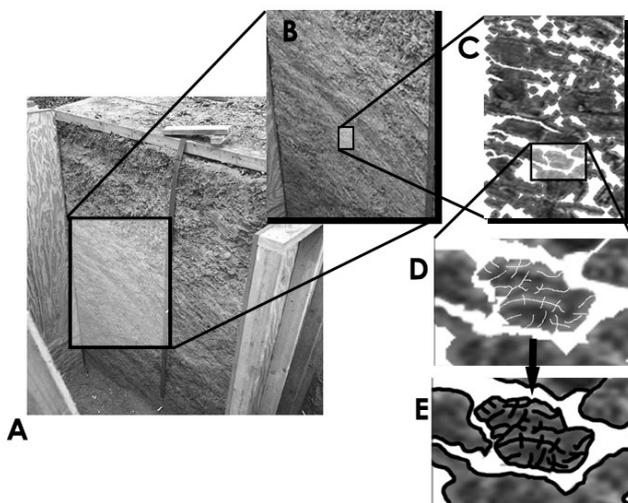
Eric E. Roden The University of Alabama, Tuscaloosa, Alabama, USA

Scott C. Brooks Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA

John M. Zachara Pacific Northwest National Laboratory, Richland, Washington, USA

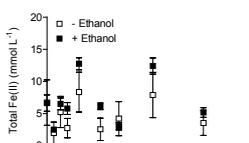
Concept/Hypotheses

Mobile radionuclides in low-permeability porous matrix regions of fractured saprolite can be effectively isolated and immobilized by stimulating localized in-situ biological activity in highly-permeable fractured and microfractured zones within the saprolite.

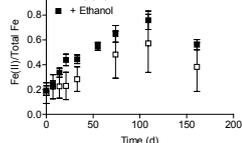


Schematic diagram illustrating the concept of a distributed microbarrier. Panel A is a photograph of a trench excavated in saprolite material (structured with multiple pore domains). Physical scale is indicated by the size of lumber in the photo; other panels are not to scale. Panel B shows an expanded view of a portion of the trench in which dipping bedding planes are visible. Panel C is based on a different photograph of a core drilled from fractured saprolitic materials and conceptually represents structure at the scale of the highlighted box in Panel B. For illustrative purposes, light-colored areas of the photo have been highlighted in white, conceptually representing macroporous regions of the photograph. Panel D shows an expanded view of a portion of Panel C, with additional details showing mesoporosity (micro-fractures) within one of the porous blocks in white. Panel E is a representation of Panel D following biostimulation; black regions represent the formation of biomass at the interface between pore domains (for simplicity, only mesoporosity in the central block is represented). Contamination in the dark grey regions of Panel E (microporous zones) is inhibited from transporting into hydraulically accessible pore space indicated in white (macroporous zones) by reductive precipitation at the biologically-active interfaces.

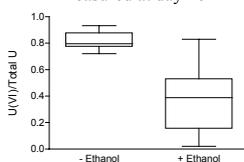
Metal Reduction Studies



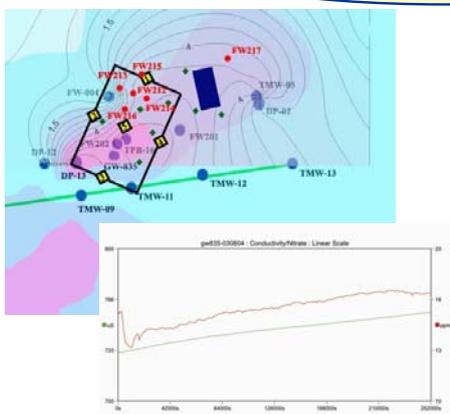
Area 2 Sediment (23-26 ft)
Slurry Incubations



Uranyl acetate added at day 96
(100µM U(VI)); U(VI) and U_{Resid}
measured at day 161



Current Field Activities



- Conduct tracer test in well FW215 (combination of multiple-well using down-gradient wells as monitoring points, and a single-well injection-withdrawal at FW215).
- Hydraulic characterization of disturbed saprolite using slug interference tests (and possibly borehole flowmeter and other methods).
- Complete construction of flow cell including geophysical wells (1-4 in figure to left).
- Continuous monitoring of groundwater chemistry in GW-835 using in-situ probe.